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# DES Calibrations: Remaining Loose Ends for Year 1

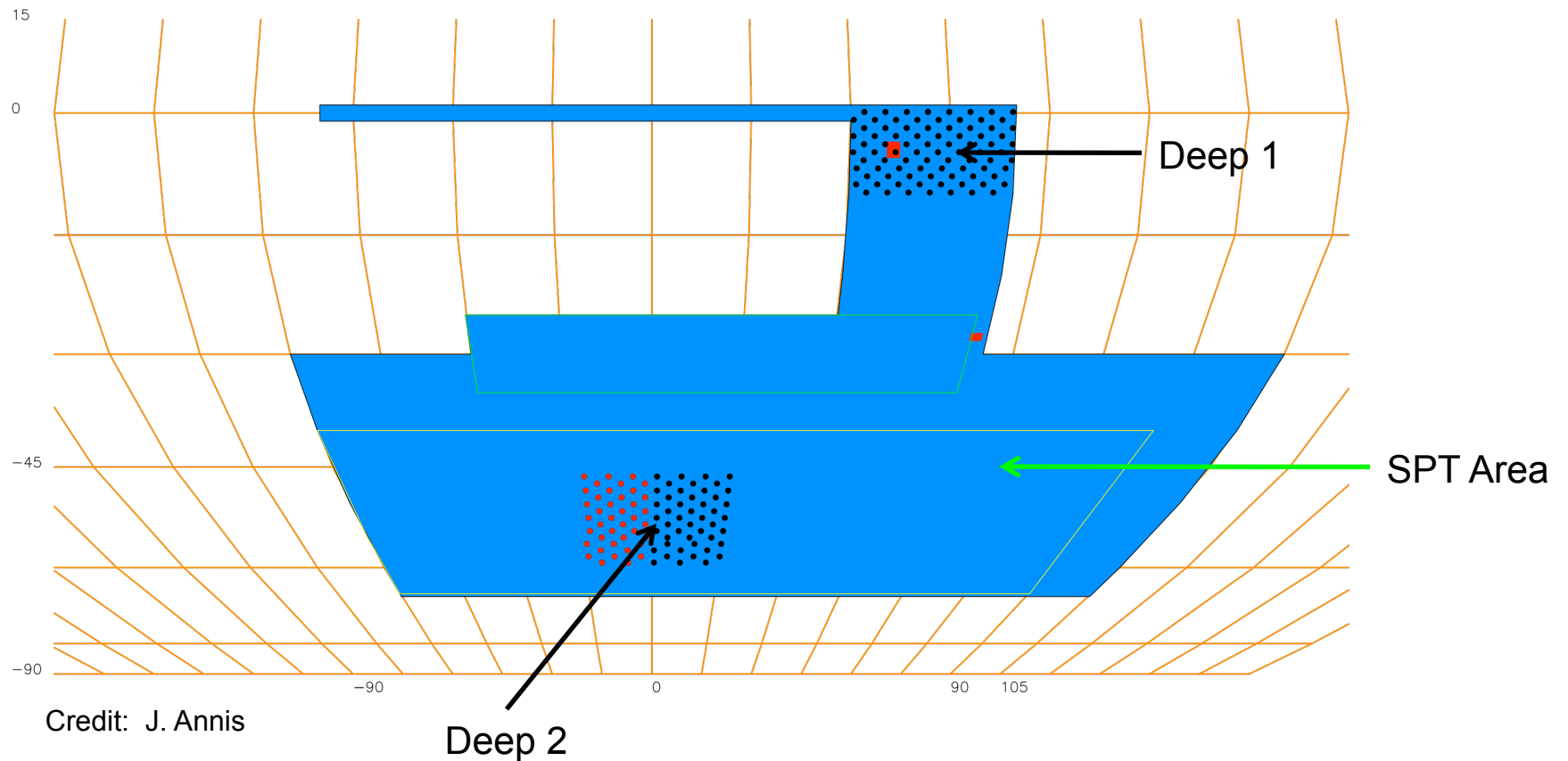
(Update: 23 March 2012)

Douglas L. Tucker



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# Current Thoughts on DES Year 1 Survey Strategy



- Deep 1 & 2: c. 500 sq deg to full 5-year DES depth (10 tilings) in each filter
- SPT Area: 2 tilings in each filter, probably only the eastern parts (say,  $RA > 0$ , if starting in September).



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# Overview

1. Standard Stars
2. DESDM Software
3. DECaI
4. Final Plans for On-Sky Commissioning
5. Contacts with other Surveys



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# Standard Stars: HST CalSpec Standards

1. Re-calculate synthetic DES grizY mags using most current version of DES filter response curves (python code by Holly Batchelor). (Done – See following slides & DES-doc#6203)
2. Finish processing and analysis of data from July 2010 CTIO-1m run that used a DECam 2kx2k CCD + DES filters (these data include observations of some of these HST CalSpec Standards). (In progress-nearly finished w/ astrom.)
3. Identify any HST CalSpec standards in the PreCam fields (→ absolute calibration of PreCam data). (Done – See following slides)
4. BD+17 4708 is important for DES on-sky commissioning. (Observed by CTIO1m in July 2010 and by PreCam on 2010 November 21-24).

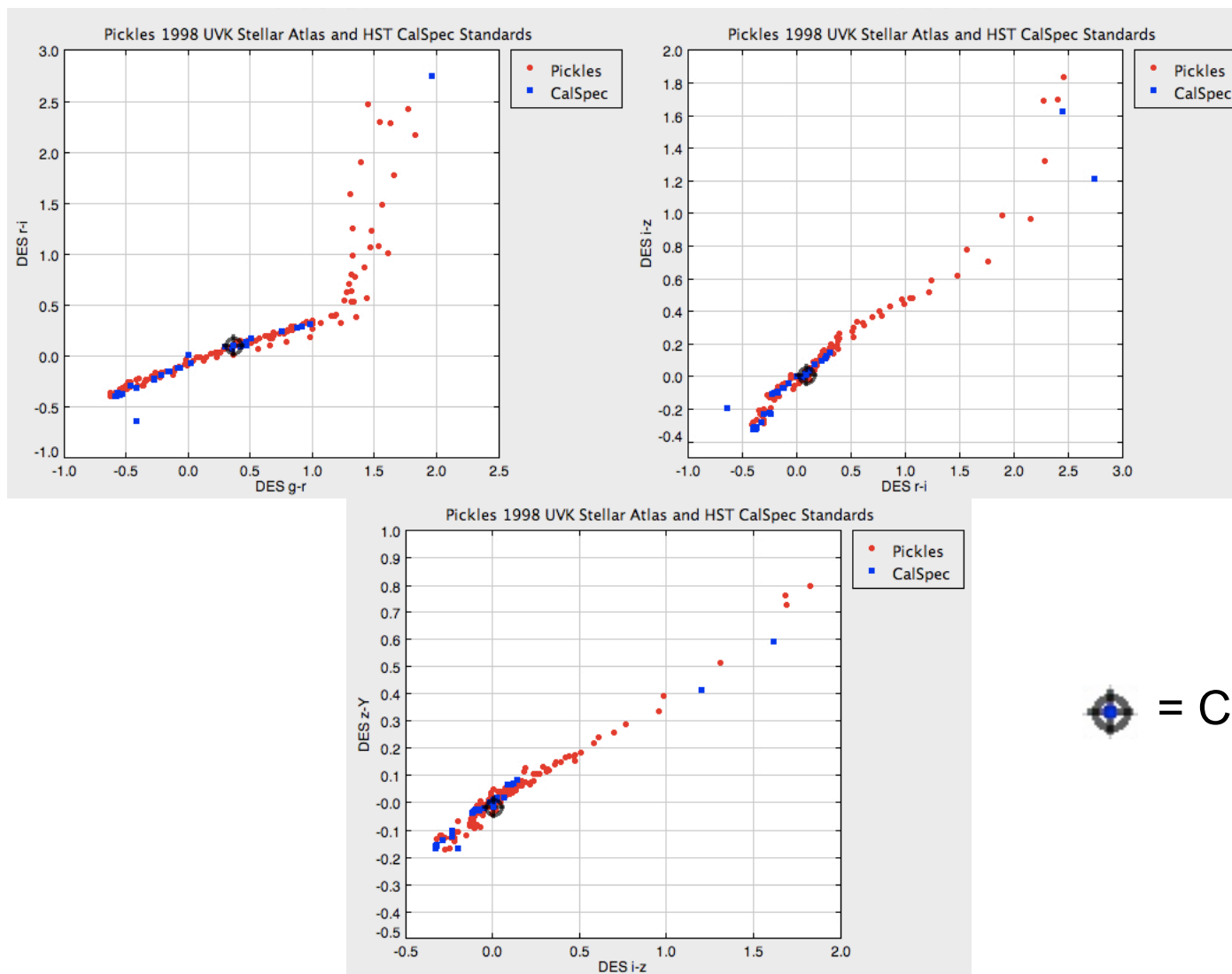


- C26202 seems to be the only HST CalSpec Standard in the main PreCam footprint.



# Standard Stars: HST CalSpec Standards

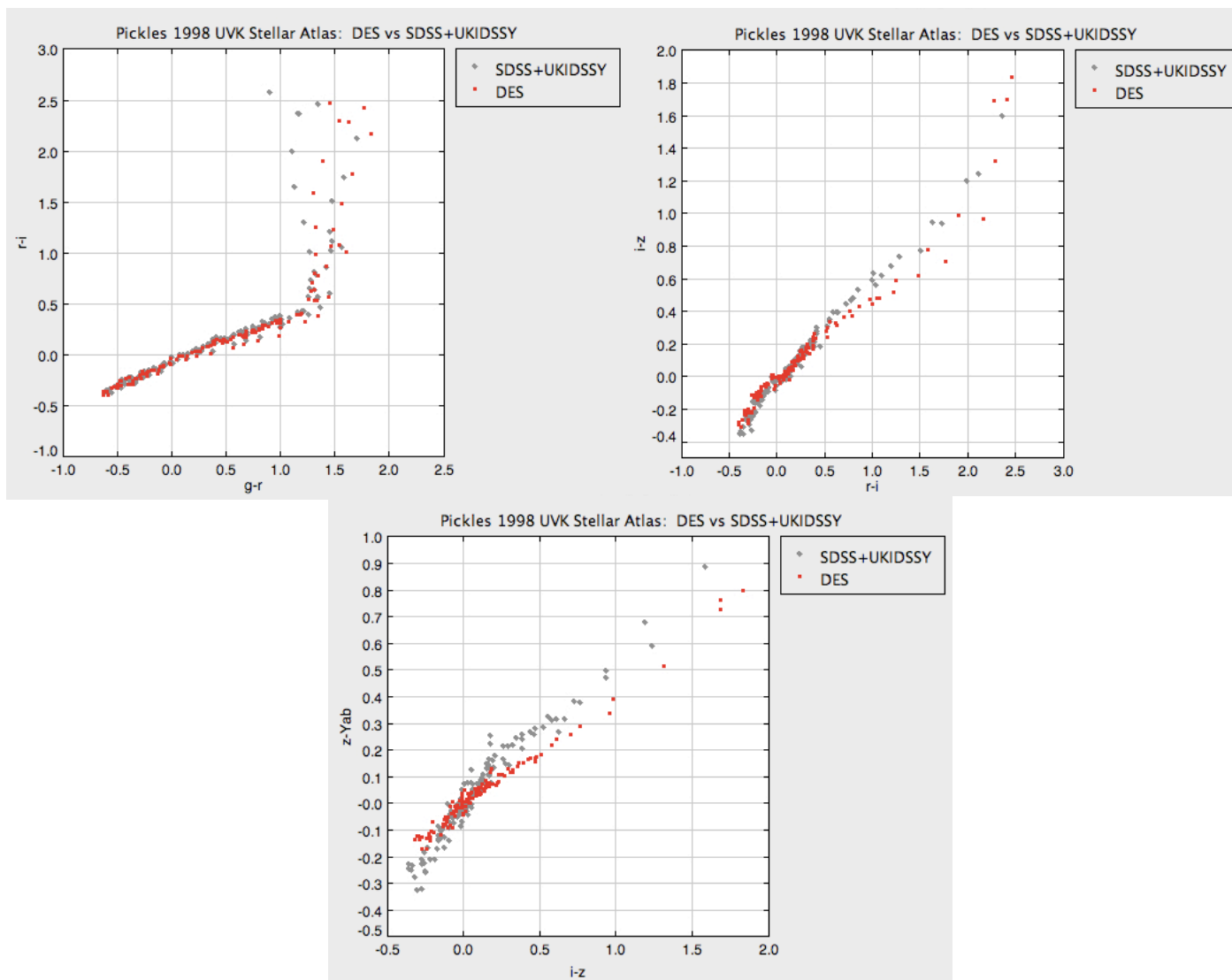
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# DES grizY vs SDSS griz + UKIDSS Yab

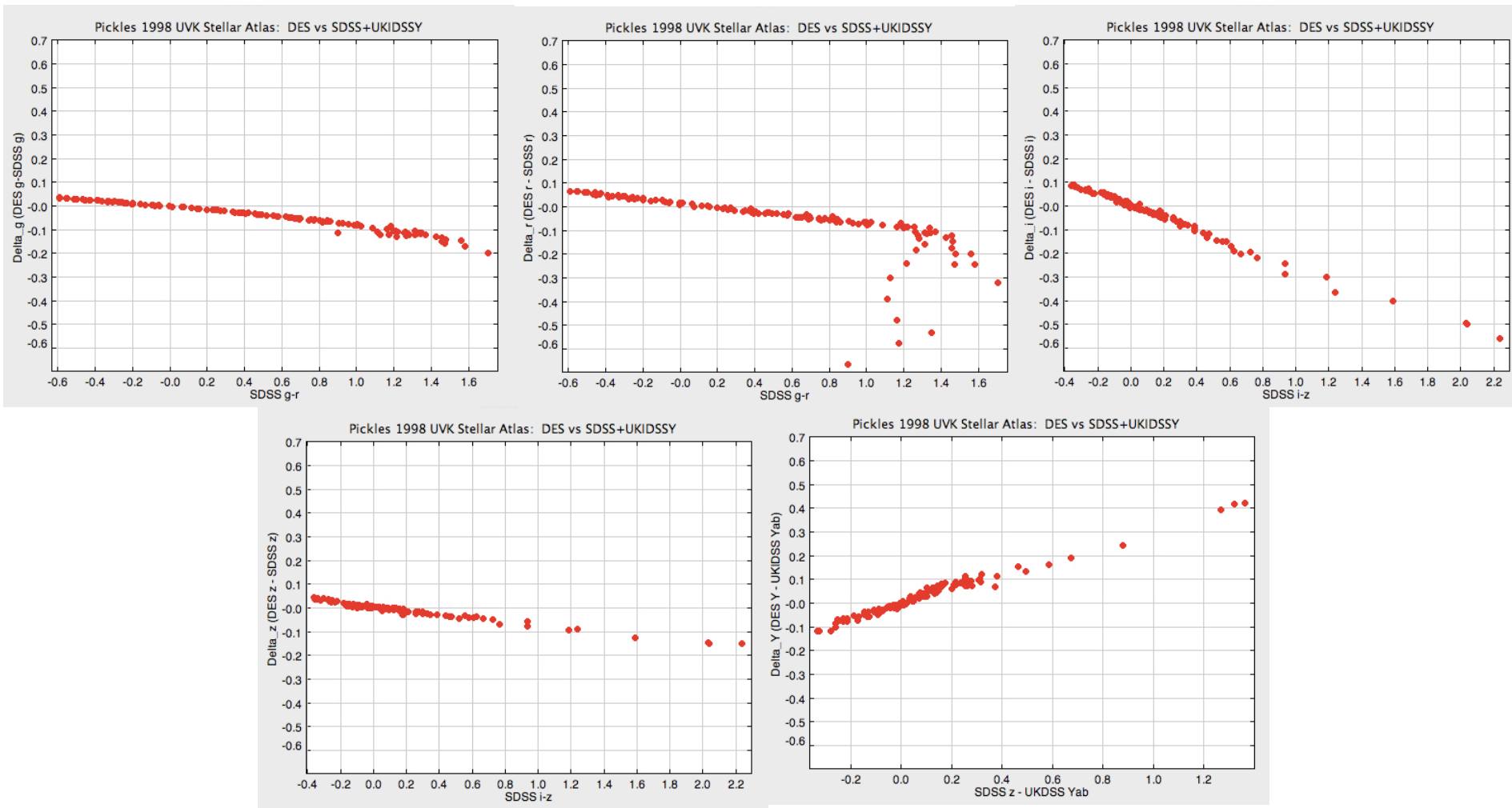
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# DES grizY vs SDSS griz + UKIDSS Yab

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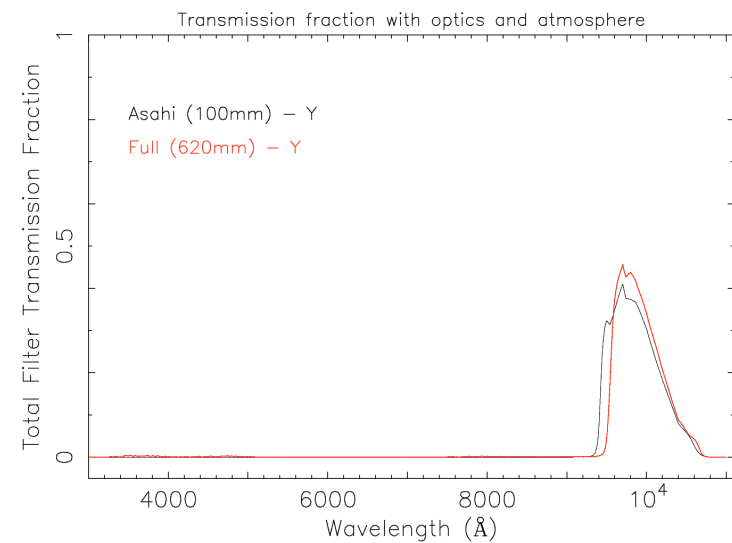
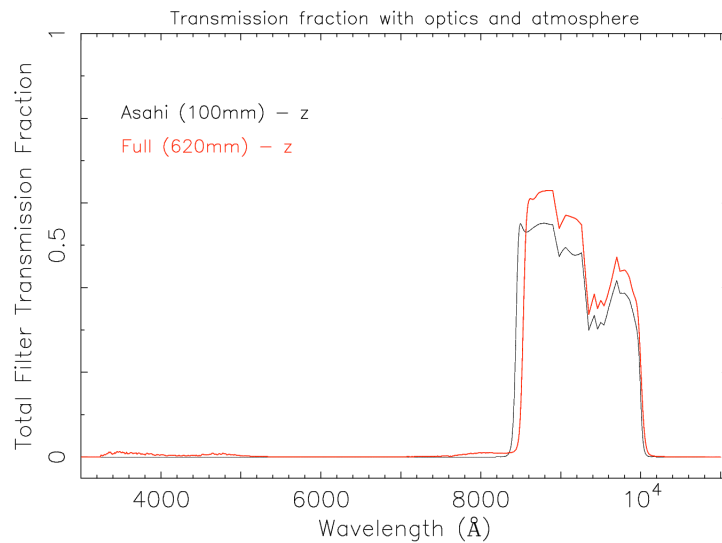
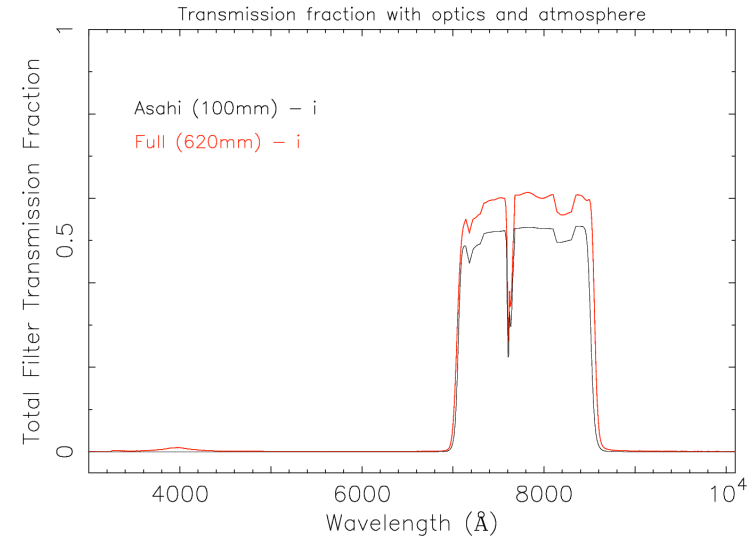
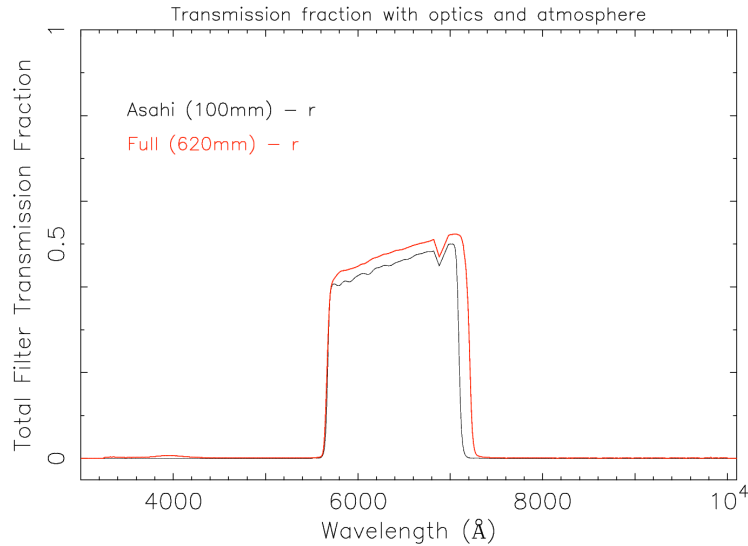




# Updated Filter Curves

(David James, DES-doc#6229)

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# Standard Stars: WD “Bronze” Sample

1. Calculate synthetic DES griz(Y) mags of all identified DA WDs with SDSS spectroscopy or equivalent (e.g., from the ARC3.5m program) that lie within the DES footprint.
  - a) Particularly within the Year 1 footprint.
  - b) Variation of Batchelor python code.
  
2. Identify any Bronze Sample DA WDs in the PreCam fields (→ absolute color calibration of PreCam data).



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# Standard Stars: PreCam

1. Finish Global Relative Calibration (including tests).
2. Use any HST CalSpec Standards and Bronze Sample DA WDs in the PreCam footprint to refine Global Absolute Calibration of PreCam photometry.
3. Refine PreCam astrometry.
4. Combine multiple observations for each star to produce a set of standard stars.
5. Finalize/refine SDSS-DES griz and UKIDSS-DES Y transformation equations using PreCam photometry in Stripe 82.



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# Standard Stars: SDSS Stripe 82

1. Re-generate Stripe 82 standard stars using DR8 coadd data?
2. Use PreCam-generated SDSS  $\rightarrow$  DES griz transformation equations to transform SDSS Stripe 82 standards into the DES photometric system.



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# Standard Stars: Southern u'g'r'i'z'

([http://www-star.fnal.gov/Southern\\_ugriz/index.html](http://www-star.fnal.gov/Southern_ugriz/index.html))

1. Brighter than Stripe 82 standards (typically  $r < 17$ ).
2. Use newest version of Southern u'g'r'i'z' catalog. (Also USNO v3 u'g'r'i'z; catalog?)
3. Use USNO u'g'r'i'z'  $\rightarrow$  SDSS ugriz and PreCam-generated SDSS  $\rightarrow$  DES griz transformation equations to transform Southern u'g'r'i'z' standards into the DES photometric system.



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# Standard Stars: BCS Fields

(<http://cosmology.uiuc.edu/BCS/>)

1. Lower grade than Stripe 82, but probably good enough for DES Year 1.
2. Two 50-sq-deg fields within the DES SPT area in SDSS griz and centered at:
  - a)  $RA = 23^h00^m$ ,  $DEC = -55^\circ12'$
  - b)  $RA = 05^h30^m$ ,  $DEC = -52^\circ47'$
3. Use PreCam-generated SDSS  $\rightarrow$  DES griz transformation equations to transform BCS standards into the DES photometric system.



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# Standard Stars: UKIDSS LAS Fields

(<http://www.ukidss.org/>)

## 1. UKIDSS Y-band in SDSS Stripe 82.

- a) UKIDSS Y is in the Vega mag system
- b) To transform to the AB mag system:  $Y_{AB} = Y_{Vega} + 0.634$ .
- c) Not the highest grade standards, but OK for DES Year 1

## 2. Use PreCam-generated UKIDSS $\rightarrow$ DES Y transformation equations to transform UKIDSS standards into the DES photometric system.

- a) Large transformation coefficient between UKIDSS  $Y_{AB}$  and DES Y.



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# Standard Stars: Interface with DESDM

1. Create a new table in the DESDM database with the same schema as STANDARD\_STARS (current table, which contains untransformed SDSS Stripe 82 and Southern u'g'r'i'z' standards). Call it STANDARD\_STARS\_YEAR1?
2. Incorporate the full set of standards from the previous slides into STANDARD\_STARS\_YEAR1.
3. Might need a trimmed version for quick matching for nightly photometric solutions.





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# DESDM Software: Photometric Standards Module

1. This is the module that performs the nightly solutions.
2. It is mature code, in use since Data Challenge 1.
3. Some minor updates have been requested.



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# DESDM Software: Global (Relative) Calibrations Module

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1. This module uses stars in the overlaps between images to calculate relative zeropoints offsets. (There is also `coadd_calczp`.)
2. Speeding up the matching algorithm is the main problem at the moment.
  - a) Oracle Spatial Functions (Todd Tomashek).
  - b) Mangle Mask
  - c) STILTS (for flat files)
3. Other improvements would be good, but perhaps not critical for DES Year 1.



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# DESDM Software: Star Flat Solver

1. A version of the Photometric Standards Module does a simplistic solution for the star flat. It requires a field of known standards (e.g., SDSS Stripe 82)
2. Another version of the code, incorporating the Manfroid (1995, 1996) algorithm would be very useful for on-sky commissioning. This could be pretty easily written in python.



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# DESDM Software: Stellar Locus/ “Zhed Point” QA

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1. We need a QA test based on the Stellar Locus or “Zhed Point”.
2. Bob Armstrong did work in the area a couple years ago, but more along the lines of implementing a Stellar Locus Regression calibration tool.
3. A python-based script to do quick-and-dirty stellar locus or “Zhed point” QA (much simpler than an SLR calibration tool) should be fairly quick and easy to implement.



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# DECaI

1. This is mostly in hand.
2. Some work by SISPI, TAMU, William Wester, & Marcelle Soares-Santos to transfer data and create response curves.
3. See talk by William and Marcelle (DES-doc#6160).



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# Final Plans for On-Sky Commissioning

1. See Alistair's "DECam Commissioning Plan (DES-doc#3734-v13), in particular Sections 6.9 ("Night Time Commissioning – Photometry and Astrometry) and star flats.
2. Alistair will be at Fermilab the week of April 16-20 for the Calibration Conference and this will be a good time to iterate on final plans for on-sky calibrations commissioning.
3. Need to define set of twilight standard star fields for ObsTac.



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# Contacts with Other Surveys

1. There are several other imaging surveys, both ongoing and upcoming, that use similar filters and overlap the DES.
2. It would be useful to make contact with these other surveys for cross-comparisons of each other's calibrations.
3. This is one of the purposes behind the April 16-19 Calibrations Conference at Fermilab:  
<https://indico.fnal.gov/conferenceDisplay.py?confId=4958>.



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# Extra Slides